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ABSTRACT

This interdisciplinary unit is intended for use in second grade classes; however, it can be used K-8 with modifications. The unit seeks to demonstrate that aquatic organisms interact in complex ecosystems and that these organisms react to their environment in different ways. Specific directions are given for setting up an aquarium and populating it with fish and plants. Specific activities are then presented using the aquarium or the aquarium theme to teach concepts in various subject areas. A bibliography of reference materials for further reading is provided. (RE)

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ED164347

Northern New England Marine Education Project

College of Education

University of Maine at Orono

Orono, Maine

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THE AQUARIUM

A Marine Education Infusion Unit

A Maine - New Hampshire Sea Grant Project

Supported in Part by NOAA, Office of Sea Grant,

U.S. Department of Commerce and by

The College of Education, University of Maine

SE 026 336

Northern New England Marine Education Project

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Orono, Maine

Acknowledgements

This unit was prepared and trial tested in schools in Maine and New Hampshire during spring 1978. Each of the units in this Marine Education Program were trial tested in a minimum of five classrooms and were revised as a result of suggestions by the cooperating teachers. Parts of these units and much of our working philosophy was derived from project C.O.A.S.T. developed at the University of Delaware and we gratefully acknowledge the leadership of Dr. Robert Stegner, director of project C.O.A.S.T. These materials were trial tested under the supervision of former assistant director Dr. Les Picker and were written by graduate students in education at the University of Maine (Orono) and cooperating teachers in the schools of Union, Maine; Freeport, Maine; and Hampton, New Hampshire. We call these units - trial units - because we hope you will try them in your classroom and modify them to suit your situation.

John W. Butzow
Project Director
January 1979

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NORTHERN NEW ENGLAND MARINE EDUCATION PROJECT

ANNOTATED LIST OF INFUSION UNITS: K-8

Trial Edition A

K Clams and Other Critters: a unit on shells (living and non-living). Includes crafts, science, language arts, home economics, math and other areas (Butzow and Jones)

K & 1 Marine Art: art and craft activities to be used in many subject areas (Picker)

2 The Aquarium: revolves around a freshwater aquarium setup. Language arts, math, science, art and others (Kilfoyle)

3 The Beaver: a study of the history, economics and natural history of the beaver. Social studies, language arts, music, arts, crafts, science, math (DiSilvestro)

4 The Lobster: explores the economics, history, biology, literature of the lobster. Home economics. art, crafts, science, social studies, literature. (Kilfoyle)

5 Whales and Whaling: a complete study of the history, biology and economics of whales and whaling. Language arts, music, math, science, social studies, arts, crafts, industrial arts. (Picker, Carkin)

6 Our Heritage of Ships: surveys the development of ships, with emphasis on New England. Science, art, music, crafts, literature, language arts, social studies. (Glueck, Butzow)

7 Ships, Shipping and waterways: explores ships and seaways today, with emphasis on New England. Social studies with excursions into science, arts. (Glueck, Butzow)

8 Coastal Indians of Northern New England: three part approach to Indian studies, culminating in an "Indian Day or Evening." Independent study suggested for Part II. Language arts, library science, music, art, crafts, social studies, marine science, industrial arts. (Picker, DiSilvestro)

Units are available from:
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Some comments made by teachers in our test schools:

"One of the things the children really enjoyed was being able to sit at the aquarium table for one whole day. They took their turn in alphabetical order (which they were never confused on). They took their fish report seriously."

"The ongoing project, the fish report chart, is a wonderful math activity for lower grade children. . . One classroom chore that everyone wants."

"The children have done many independent activities so far with this unit - drawing pictures, writing stories, reading books on fish and observing fish in the tank."

"Class enjoyed fish. Many couldn't keep away from tank."

2b

TITLE: The Aquarium

*MARINE CONCEPT: 3.21, 3.22

3. - Marine Organisms Interact in Complex Ecosystems

3.2 Marine organisms are adapted to their environments in different ways.

3.21 Marine organisms are adapted developmentally, structurally, and behaviorally to their environments.

3.22 Organisms in a marine community interact in balance with their environment and with one another.

GRADE LEVEL: 2 (can be used K-8, with modifications)

SCHOOL SUBJECTS: Literature, language arts, math, art, science, recreation

CLASS PERIODS: various (6 - ongoing)

AUTHOR: Steven Kilfoyle

CONTRIBUTORS: Gene Berg, Louise Calkins, Bob Jones, Elizabeth McClain, Louise Merrill and Cecilia Ziko

*The conceptual scheme is from A Conceptual Scheme for Marine & Coastal Environmental Studies, 1973. Available from Dr. Robert Stegner, University of Delaware, Newark, DE 19711.

THE AQUARIUM

The Aquarium Unit is designed to familiarize young children with a few examples of aquatic life. Some of the basic principles to cover are: a fish's ability to breathe with gills (the snail's gills are inside its shell), the many varieties of shapes and colors of fish, what life in the water might be like and how pets should be taken care of. These and any other concepts you may wish to add should be brought up in discussions and in any of the various exercises provided.

The actual setting up of the aquarium should be done with the class participating, this should prove to be quite motivational. It would be a good idea to have the tank and other equipment in the room a day or two before setting up. It gets the kids asking questions, speculating, suggesting. The children will also learn how to set up their own aquarium if they are interested in doing so. Emphasis should be placed on the fragility of the glass aquarium, so that the children will keep this in mind when working with, and around it.

It is recommended that you begin this unit by reading to or with the class Leo Lionni's book, Fish is Fish (Pinwheel Books, 1974). Use the suggestions and do the exercises in the Language Arts section in this unit related to Fish is Fish. Next, set up the aquarium with the children and begin using the various other exercises described in the unit. An excellent follow up activity would be a trip to a nearby aquarium, such as the New England Aquarium (Boston, Mass.) or the Southwest Harbor Oceanarium (Southwest Harbor, Maine). The aquarium and its occupants can be used for the entire year as a science teaching or arithmetic teaching tool, or for any other subject area application.

AQUARIA

Setting Up

Equipment:
1 38 liter (10 gallon) aquarium
1 air pump
1 aquarium heater
1 aquarium filter
filter floss
filter charcoal
70 cm of air tubing
4.5 kg (10 lbs) aquarium gravel
1 aquarium thermometer
1 aquarium hood (optional)

Begin setting up the aquarium by finding a suitable place for it. This location should be level, somewhat out of the way, well lighted (but not in direct sunlight as this will cause excessive algae growth) and easily observable by a number of students. Avoid putting the aquarium over heaters or in an area where there is likely to be a lot of traffic, and make sure there is an electrical outlet nearby.

To begin the actual setup procedure, first wash the aquarium (without soap), making sure the glass is as clean as possible. Next, rinse the gravel to remove the fine dust that accumulates in storage and shipment. Carefully put the rinsed gravel into the aquarium, use about 4.5 kg (10 lbs) in a 38 liter (10 gallon) aquarium. If you intend to plant many aquatic plants in your aquarium it might be beneficial to mix a small amount of good rich garden soil or commercial potting soil with the gravel (about 0.5 kg (1 lb)). In this case, you may also need more gravel. If you use potting soil, do not use a mix that contains vermiculite or perlite because both are very light and will only float on the surface of the water.

The aquarium is now ready to be filled with water. Place a plate or a bowl on the gravel and pour water into it, filling the aquarium until about half full. This helps to prevent the gravel from being disturbed. You should be able to carefully fill the rest of the aquarium without stirring up the rest of the gravel bed. Stop adding water when the level is about 2.5 cm (1 inch) from the top of the aquarium. Set up the filter according to the instructions accompanying it. Usually a layer of activated charcoal is on the bottom and a layer of filter floss is over the charcoal. Now, hook the filter up to the air pump with the plastic tubing and place the filter in the back corner of the aquarium. The air pump can now be plugged in and the filter should begin working immediately. You will notice that water is probably quite cloudy now. The filter should clear up most of this cloudiness overnight.

At this point, you are ready to add the heater. DO NOT PLUG THE HEATER IN UNTIL IT IS SET UP IN THE AQUARIUM. If you do, the glass tube which encloses the heating elements will break when it comes in contact with the water. Attach the heater to the back of the aquarium and adjust it as the instructions which come with it recommend. When you are sure the heater is firmly attached to the back of the aquarium, plug it in. Within a few hours the heater should have the water warmed to a constant temperature. You should aim for 21-26 degrees Centigrade (70 - 80 degrees Farenheit). Next, if you have purchased an aquarium hood, place it on top of your aquarium. A reflecting hood for your aquarium, although optional, is a worthwhile investment. A hood will not only keep out much of the chalk dust which floats around a classroom, it will also deter

most airplanes, spitballs, and other projectiles of reasonable size. Special light bulbs can also be purchased which will increase plant growth and intensify fish colors. In general though, these reflectors are somewhat expensive. A makeshift cover can be constructed of wood or glass to prevent dust accumulation.

Finally, all of your equipment is set. Check to make sure everything is working properly, and allow the aquarium to filter overnight before adding any fish or plants. This wait will also get rid of any chlorine in the water, which would kill any fish if they were added right away.

POPULATING THE AQUARIUM

The number of fish to put in the aquarium is variable. Ask the pet store person what types would be most compatable. In general, try to buy different numbers of each kind of fish. The math activities in this unit will most easily be applied if you purchase for example: 1 catfish 2 small angelfish, 3 neons, 4 guppies, and 5 snails. These numbers and species are just hypothetical; any recommendations of the pet store person should be taken into consideration, i.e. fish on sale.

Don't overlook the possibility of planting various types of aquatic plants in your aquarium. The plants will not only make the aquarium much more appealing and natural looking, but they will provide natural hiding places for fish, and the fish in turn will be much happier and healthier. Once again, the pet store person should be able to suggest two or three types of aquatic plants which are fairly hearty and are easy tc maintain.

If you plan to use plants in your aquarium, they should be planted first before any fish are released. If you should decide to purchase some aquatic plants after your aquarium has been populated with fish, try to plant them as carefully as possible, attempting not to stir up the sediment in the gravel too much. When deciding where to place plants in an aquarium, you should keep in mind that taller plants should be planted toward the back of the tank and shorter plants should go toward the front progressively. One large flowing plant, like an amazon sword plant, looks quite attractive in the center of an aquarium.

When planting aquatic plants in an aquarium, care should be taken not to harm the roots any more than is necessary. First, dig up

a few trenches radiating out from the point where you plan to put the plant. Now make an indentation where the base of the plant will go. Place the plant in the indentation and spread the roots out in the trenches. Cover the roots with gravel and surround the base of the plant with gravel to anchor it. This procedure should be followed with all plants which have a well established root system. Many plants purchased in pet stores come in bunches, held together with a rubber band. Bunched plants often have little, if any, root system; once separated they can be planted by just anchoring them in the gravel and like houseplant cuttings, they will root and grow.

When introducing fish into the aquarium, care should be taken to gradually accustom them to the aquarium water. The fish will come in plastic bags filled with water. First, these bags should be placed in the aquarium so their temperatures will become equal to that of the aquarium water. After about ten minutes, dump about one-third of the water in each bag out and replace it with water from the aquarium. Do this two more times at ten minute intervals. After ten more minutes, open the bags and let the fish swim out on their own free will. After about half an hour, give the fish a small amount of food. If they eat it all give them another small amount. At the end of the day, feed the fish the amount recommended on the fish food container. From now on, feed your fish the recommended amount daily. Plan on large feedings for Mondays and Fridays, and your fish should survive the weekends. For long weekends and vacations you can purchase feeding blocks which will last for up to two weeks, or you may be able to enlist the aid of a janitor to carry out feeding chores.

LANGUAGE ARTS

Use the aquarium vocabulary to teach and practice formation of letters in cursive writing.

Spelling Activity

A. Learn to spell the following words. This will be reinforced through use of the crossword puzzle which follows.

water	neon
pump	gravel
plant	aquarium
catfish	angelfish
snail	filter
guppy	

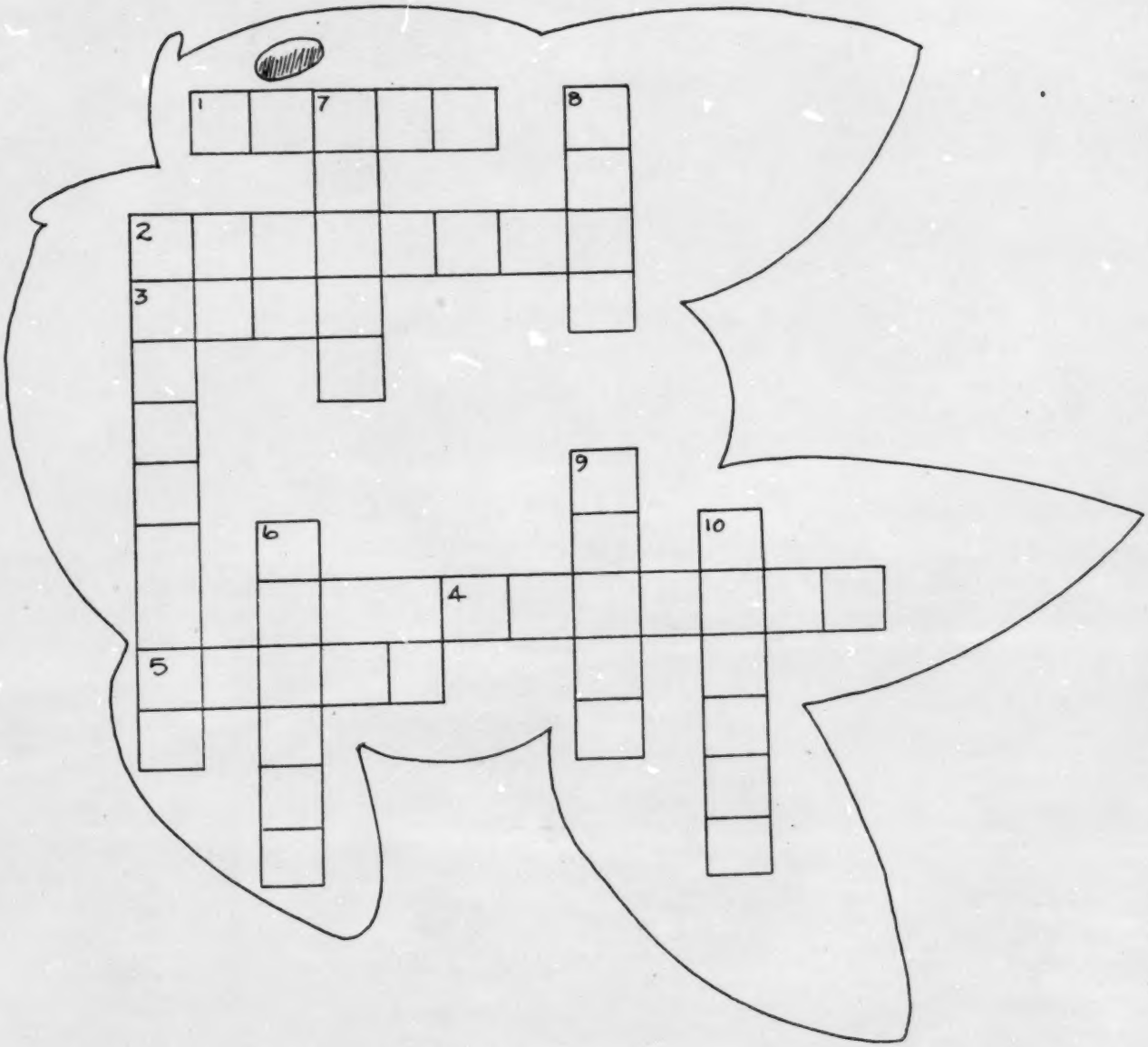
B. Do the crossword puzzle.

Across

1. The very pretty fish in our aquarium which have big tails
2. Where our fish live
3. The brightly colored fish in our aquarium
4. The fish that lives on the bottom of our aquarium
5. The animal that creeps along the side of our aquarium

Down

2. The fish in our aquarium that has stripes going up and down its body
6. The rocks on the bottom of our aquarium are called?
7. Something that is green and grows in our aquarium is?
8. The box that hums and pushes air into our aquarium
9. We can drink this, but not when it is in our aquarium
10. The box which bubbles in our aquarium



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C. Either read to the students, or have them read the book Fish is Fish by Leo Lionni. Discuss the major concepts in the book using the following questions as a guide, or discuss the major concepts and then have the children answer the questions.

1. Who were best friends in the book?
2. What did the tadpole become when he grew up?
3. Where did both the tadpole and the minnow live?
4. When the minnow grew up, what did he become?
5. What did the frog see when he left the pond?
6. Why do you think the fish wanted to leave the pond?
7. What happened when the fish jumped out of the pond?
8. What did the fish say once he was in the pond again?
9. What did the fish mean when he said "fish is fish"?

D. Crossword Puzzle on Fish is Fish

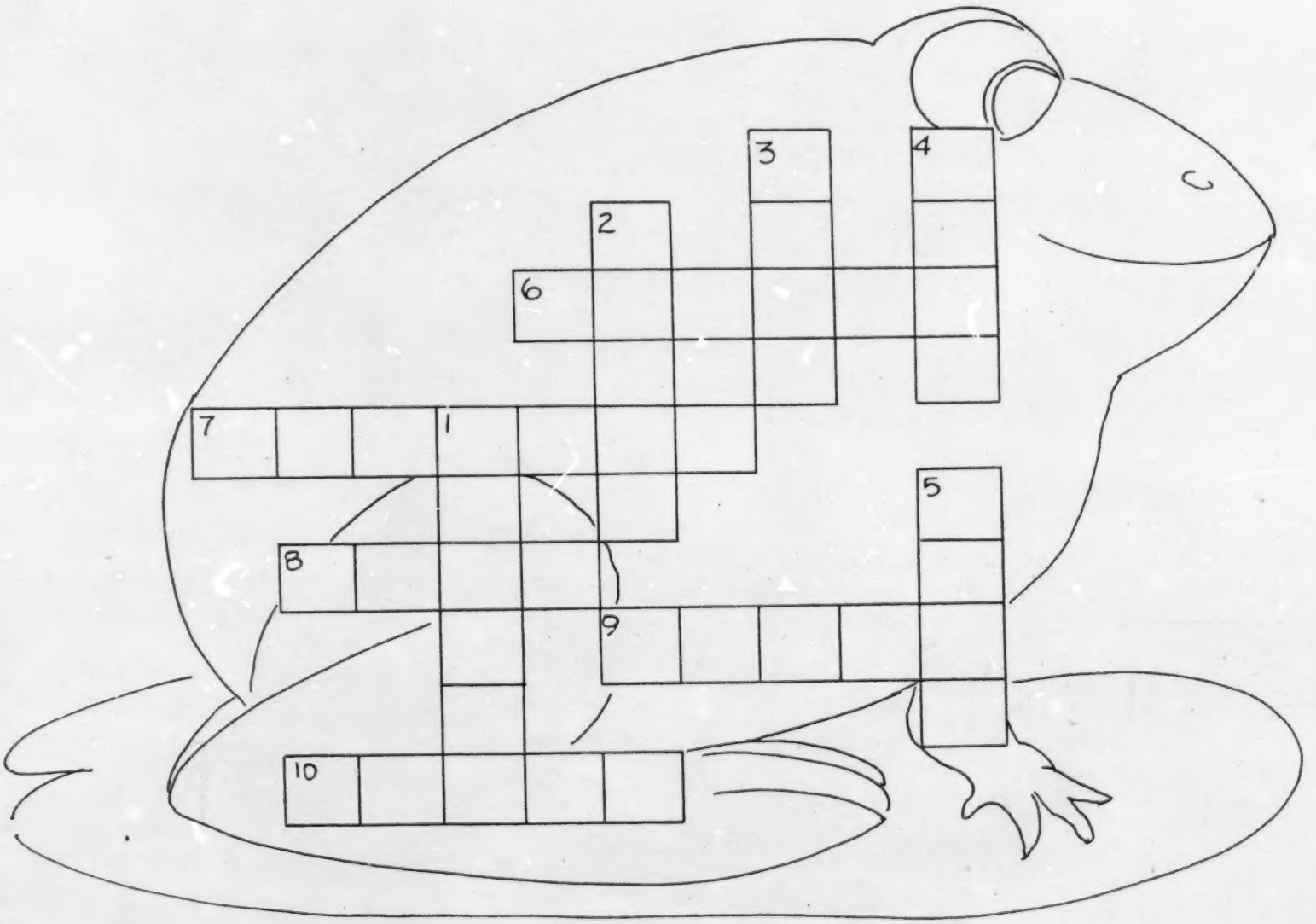
minnow	fish	gills	cows	tadpole
people	pond	weeds	frog	birds

Down

1. When the frog left the pond who did he see wearing clothes?
2. Through what does a fish breathe air?
3. Where did the fish and tadpole live?
4. When the frog left the pond who did he see carrying pink bags of milk and with horns?
5. What did the minnow grow into?

Across

6. Who was the tadpole's best friend?
7. What was the baby frog?
8. Who saved the fish when he jumped from the pond?
9. Who did the frog see flying?
10. What were the plants growing in the pond called?


1
2
3
4
5
6
7
8
9
10

E. Creative Writing:

The objective is to encourage the children to express themselves in-writing. The procedure is to give the children a variety of story starters related to the aquarium and let them write. Discuss the topics beforehand to stimulate their creativity. The children should also illustrate their stories. The finished products may then be typed and run off and then bound into booklets for distribution. If the childrens' illustrations are drawn on masters they may also be duplicated.

Story Starters

1. If I were one of the animals or plants in the tank
2. What my old home in the pond was like
3. The strange people on the other side of the glass
4. Why I like (or dislike) my new home
5. Getting used to my new home
6. If I were a catfish
7. If I were an angelfish
8. If I were a neon
9. If I were a guppy
10. If I were a snail
11. I was swimming in the water when
12. It's fun being a fish

ART ACTIVITIES

Interested students can make posters of common fish, fish diseases, aquarium plants, etc.

A. Aquarium Diorama and Mobiles

Materials: shoe boxes
construction paper
crayons
scissors
string
tape
plastic wrap
wooden dowels

Have each student color an underwater background on the inside of a shoe box. Then let the student draw, color, and cut out various fish and plants. These can then be hung with string or taped to the inside of the box.

In another activity, have the students draw, color and cut out large fish and plants to be used in making an aquarium mobile.

B. Stuffed Fish

Materials: construction paper
scissors
stapler
cotton
crayons

With the children's own drawings of fish or other aquarium life, the class can make stuffed fish. First cut out one of the patterns or an original drawing. Now trace around the pattern on two pieces of construction paper. Cut out and color both of the tracings, so that when they are put together the colored sides will face out. Staple both of the halves of the fish together, leaving enough room at the head or at some convenient point to stuff cotton in. Finally,

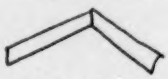
stuff the fish with cotton and finish stapling the opening. These stuffed fish can now be pasted onto "plaques" cut out of brown construction paper or they can be used to make an aquarium mobile.

C. Woven Fish (This activity may be difficult for many second graders.)

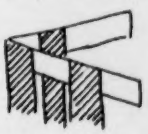
Materials: (6) 1" x 12" strips of colored onstruction paper (two colors)
scissors and glue or paste
string

Steps:

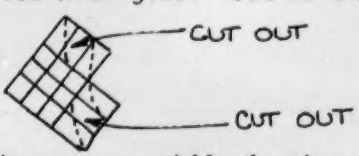
1. Fold the strips of construction paper in half. Interlock two pieces as shown and paste in place.



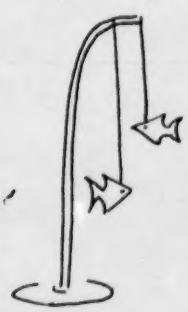
2. Weave three strips onto one strip on alternate edges. Secure with paste or glue.

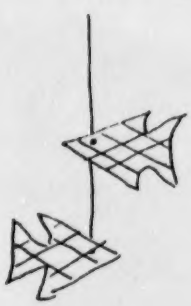


3. Weave in the cross strips, first one side and then the other. Secure all strips in place with glue. Cut as shown.



4. The folded fish can be hung as a mobile in these ways:





D. Macaroni Fish

Materials: oaktag or cardboard
elbow macaroni
any other type of macaroni you may want to use
paste
crayons

Draw on the oaktag or cardboard a large fish outline. Cut the fish out. Have the children color the various macaroni pieces the colors of the fish you wish to make. Paste the colored macaroni pieces onto the oaktag fish making stripes, bars or any other "fishy" designs. The "macaroni fish" can now be hung on the wall. If both sides are done with macaroni, the fish can be hung from the ceiling.

E. Finger Painting

The children should use finger paints to paint fish, aquarium scenes, or any other aquarium related topics.

F. Aquarium Background

On paper large enough to cover the back of the aquarium, have your students draw an underwater scene using the whole piece of paper. These scenes can then be used to background the aquarium by taping them to the back of the tank. Change the scenes every few days so each child's picture is used. This could also be done quite well using a large diorama with older groups.

MATH ACTIVITIES

A. Each day assign one or two students to count and feed the fish in the aquarium. The student(s) should also report on the condition of the fish: if any look sick; if they seem to have eaten a good meal; and most important of all, if there are any baby fish!

B. Make up your own arithmetic problems like four guppies plus two angel fish equal six fish.

C. The set theory can also be taught, but using each type of fish and their numbers as sets.

Fish Report Chart

To prepare a chart on which the children can report the conditions of the aquarium inhabitants, begin by sectioning off a large piece of paper into a calender. In each date block, write the names of the various fish, then draw lines where the numbers of each type can be written. Draw another set of lines next to the first ones where the children can report on the conditions of the fish. To report on the conditions of the fish, the child(ren) should write "ok" or draw a happy face (◡) if the fish seem to be happy. If one fish looks sick or sad, the child(ren) should write 1 ⁀ (a frown) on the appropriate line.

1		
catfish	1	ok
angel fish	2	ok
neons	3	
guppies	4	1⁀
snails	5	

MUSIC

Much understanding can be gained in an easy and interesting way through music. Use the records listed in the bibliography of resources and/or any appropriate songs in your songbooks. Your children may even want to make up their own songs or poems.

On the following pages you will find information which will help the children understand how a fish gets air and swims, and where tropical fish come from. The information was gathered from An Aquarium by Blough and Parker, an excellent resource.

TROPICAL FISH

Most tropical fish live in Central America, South America, Asia and Africa. These countries are near the equator. The weather near the equator is almost always warm.

Some tropical fish live in the sea. They are called saltwater tropicals.

Some tropical fish live in lakes, rivers, streams and ponds. They are called fresh-water tropical fish. The fish we have in our classroom are fresh-water tropical fish.

Tropical fish are usually caught by people who live in the countries where they are found.

Sometimes people who sell tropical fish take trips to collect them.

The fish are taken to seaports or airports. There they are shipped or flown to the United States or other places in the world.

In the United States, trains, trucks and airplanes take them to all parts of the country.

Finally they reach pet stores.

Many tropical fish are raised in our country by people who sell them.

Tropical fish that have their babies born alive are called live-bearers. Those that have babies that are hatched from eggs are called egg-layers.

HOW A FISH GETS AIR

Fish open and close their mouths all day long and all night, too. They are taking water into their mouths.

A fish does not swallow the water that goes into its mouth. The water comes out through the long slits on the sides of its head. There is air in the water. The air has a gas called oxygen in it. The fish uses this oxygen from the water. This is the way fish breathe.

A fish cannot live without oxygen. Every living thing in the aquarium needs it, even the plants. You cannot live without it, either. You take air into your nose and it goes to your lungs. You breathe with lungs. Your lungs take the oxygen from the air.

A fish does not have lungs. Lungs are of no use for breathing underwater. A fish has gills that take the place of lungs.

The gills of a fish are on the sides of its head. When water goes into the mouth of a fish, it goes to the gills. The gills take the oxygen out of the water. Then the water comes out of the long slits on the sides of its head.

This is why a fish is always opening and closing its mouth, and why the slits at the sides of its head open and close.

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RECORDS

Nature Songs, More Nature Songs,
Can be purchased through Educational Record Sales, 157 Chambers St., N. Y., N. Y. 10007.

FILMS

An Aquarium in Action , Xerox, About Animals Series

Setting Up an Aquarium, Xerox, About Animals Series

The Fish that Nearly Drowned, Coronet